



## **ORIGINAL ARTICLE**

### **AN INTEGRATED APPROACH TO UNDERSTANDING THE DETERMINANTS OF HOME BIRTHS IN A RESOURCE POOR SETTING**

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#### **Abstract**

Globally deliveries are still being conducted in homes and not assisted by skilled professionals, thus creating obstacle in further reduction of maternal mortality. Two hundred women, were interviewed about place of delivery and the reasons for opting for the same. Forty percent either delivered or planned to deliver at home. Distance to the hospital made 28 (35.4%) women chose home delivery and 17 (21.5%) women did so due lack of escort to the hospital. Pregnancy without complication can be delivered at home and too much of work pressure at home were common reasons for homebirths. Auto rickshaw was the commonest mode of transport to the hospital (54%). There was significant clustering of homebirths (  $p < 0.001$ ). Relative risk of home delivery was 2.63 times that of hospital delivery in a subset of sample. Spatial regression model did not show any significant predictors of home delivery.

#### **Key words**

Homebirth, determinants, institutional delivery, spatial analysis, maternal health

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## Introduction

Improving maternal health is one of the Millennium Development Goals for 2015 set by United Nations Development Program (UNDP)<sup>1</sup>. Globally, there were an estimated 289 000 maternal deaths in 2013 of which 69% were in southern Asia<sup>2</sup>. India contains on the the largest concentrations of maternal deaths worldwide, and despite a 65% drop in maternal mortality from 1990 to 2013, continues to fall well short of the target to be achieved in 2015. Based on epidemiological knowledge, a health center intrapartum care strategy, that is all births should take place in a health facility under guidance of skilled birth attendant, is considered as best to bring down high rates of maternal mortality<sup>3</sup>. India has embraced this approach in its efforts to reduce maternal and infant mortality under the National Rural Health Mission (NRHM)<sup>4</sup>. Birthing facilities are being created and cash incentives are being offered to poor families for availing these facilities under *Janani Suraksha Yojana*, a 100% centrally assisted conditional cash transfer scheme<sup>5</sup>. With these efforts institutional delivery in India improved from 26% in 1992-93 to 33.6% in 1998-99 and to 40.8% in 2005-06 according to the three National Family Health Survey reports<sup>6-7</sup>. At present the figure stands at 47%<sup>8</sup>. Despite this impressive progress, a majority of birth still take place in homes, unassisted by skilled professionals, thus presenting potential risks to the mother and infant.

Factors influencing women's choice of whether or not to deliver at home or in a medical in Indian settings have been extensively studied. Role of ante natal care<sup>9,10</sup>, economic status and access<sup>11</sup>, and customs and practices<sup>12</sup> in determining choice of institutional delivery has been extensively documented in Indian settings. Sugathan et al after analysing the National Family Health Survey (I & II) data using logistic regression and adjusting for potential confounders concluded that mothers who received ante-natal care services were two to five times more likely to give birth in a medical institution than those who did not receive antenatal care.<sup>9</sup> Thind et al after analyzing birth records of 1510 births in Maharashtra, found that women who had more than three antenatal visits were 74% less likely to give birth at home compared to those who had no or less than three antenatal checkups.<sup>10</sup> According to Kesterton et al, rural women in the richest quartile were three times (OR 3.76) more likely to deliver in a hospital as compared to the poorest quartile women.<sup>11</sup> Das et al showed that customs were the most commonly cited reason for home births.<sup>12</sup> Similar findings have been reported from various developing countries in Asia as well as Africa. Moran et al reported from Dhaka, Bangladesh, that 84% of deliveries in slum areas

took place at home<sup>13</sup>. Similarly, studies conducted in Bolivia<sup>14</sup>, Ghana<sup>15</sup>, Tanzania<sup>16</sup> and Nepal<sup>17</sup> have found that literacy, wealth and access are important factors in determining place of delivery.

Gabrysch et al (2009) in a review article, based on two previous reviews and 80 original articles, grouped the determinants of institutional deliveries into four groups namely: socio-cultural, perceived benefit/need of skilled attendance, economic accessibility and physical accessibility<sup>18</sup>. This makes us believe that there are myriad causes contributing to inadequate achievements in institutional delivery.

Even in metropolitan cities like Delhi, where there are more institutional facilities available and accessible, 29% births took place at home and this figure is substantially higher in slum areas at 40%.

The above discussion pointed to the fact that several research studies have focused on role of various predictors of home delivery in a piecemeal approach and these studies have used large data bases covering whole country<sup>9-11</sup> or a large state<sup>12</sup> and therefore failed to capture factors which are locally relevant to a specific group of population. Further, none of these studies have incorporated the spatial perspective in its reasoning. Given that women have to travel distances in the late stage of pregnancy or after onset of labor, location of institutions for delivery and ease of access must be playing significant role in selection of place of delivery and that can be analyzed using spatial analytical approaches. In order to examine the role of spatial predictors along with the known predictors, we conducted this study. The basic objective of the study was to determine role of distance and access in choice of place of delivery among women from low socio economic back ground.

So we conducted this study in low income neighborhoods of one administrative district of Delhi to examine whether determinants like location of hospitals, distance and ease of access were significant determinants of home delivery besides the variables which are already known to influence the decision to deliver at home.

## **Material and Methods**

A cross sectional survey was conducted in low income neighborhoods in north-east district of Delhi. About 200 women who had given birth in the last year or were pregnant at the time of

data collection were interviewed using a structured questionnaire from 10 selected neighborhoods. A list of all low income residential neighborhoods was prepared after a walk through and with the help of a digital map of the district. A set of 10 such neighborhoods were selected, covering the length and breadth of the district As shown in Fig 1. Among the selected neighborhoods, distances with respect to hospitals are given in Table 1. In each colony, through house to house visits, women with a child of less than 1 year or currently pregnant were selected.

Data collection was carried out between October 2013 and February 2014.

The sample is selected in such a manner that the geographical terrain in question is represented using a grid form, so that no part of the geographical area goes unrepresented. Each selected geographical area was divided into small square grids, the data collector visited each grid and ensured that at least one pregnant was selected in each grid. This process was repeated for all geographically identified colonies using the map of Municipal Corporation of Delhi.

In such scenario, a random number based random sample may not be truly spatially representative, hence it is a convenience sample and not a random sample in statistical sense. However, after data collection, the continuous variables were tested for its probability distribution and all variables were found to be normally distributed, hence it was appropriate to use parametric tests for significance.

Although at least 15 cases were to be selected from each neighborhood, due to refusals or due to small size of colonies, only 13 women from one colony and 14 women each from three colonies could be selected. The geo coordinates of each household were recorded using a GPS enabled smart phone. The coordinates were recorded standing on the street in front of the entrance or in the porch. In 10% of cases, the coordinates were cross checked using a Juno<sup>®</sup> SA Handheld GPS device for accuracy check. No significant discrepancy was found in the coordinates.

The study was done under Faculty of Management Studies, University of Delhi and guided by the code of ethics recommended by the University for this purpose. Written, informed consent was obtained from each participant. A structured, questionnaire was developed and pre tested on a set of 10 women before starting actual data collection. In some households, because of cultural practices, the response was given by a male adult member of the household instead of the woman included in the study. Questions were asked about the place

of child birth (home or institution) or intended place of child birth. Reasons for selecting the option were first asked using an open ended question. Subsequently, a list of reasons was presented to enquire about possible other reasons for choosing to deliver at home or hospital. Information was also gathered about mode of transport, distance travelled and expenditure incurred on travelling to hospital for delivery. All recorded answers were converted into a digital spreadsheet using MS Excel software. Data were cleaned and errors corrected by cross checking from the paper questionnaire prior to data analysis.

**Data analysis:** Descriptive tables for relevant variables were generated using IBM SPSS V20.0. Geocoded maps and spatial analysis was carried out using Arc GIS 10 (ESRI) and SatScan<sup>TM</sup>.

**Output:** The point of enquiry was whether the delivery took place at home or in an institution (Hospital) in case of women with infant and intended place of delivery in case of pregnant women. Factors taken onto consideration were enumerated including distance to the institution, cost, mode of transport and other factors that governed the decision process.

## Results

Two hundred women were contacted in 10 low income residential colonies of north-east district of east Delhi. Area wise break up is given in Table 1.

Figure 1 shows location of colonies on a street map of N-E district of Delhi.

A majority of the respondents (82%) had delivered a child in the last year. Average age of the respondents was  $26.6 \pm 8.49$  (S.D.) and 83% were below 30 years of age. Of the 200 women, 80 (40%) either delivered or planned to deliver at home. The reasons given for delivering at home are given in Table 2. For those who already had delivered, the common reasons for delivery at home were lack of time to reach hospital, unavailability of escort to hospital and absence of any perceived complication requiring hospital delivery.

Distance to the hospital was the reason for homebirth in case of 8 (10%) women. One third (35.4%) of those who delivered at home or chose to deliver at home did so because they found the distance to be prohibitive. No one to escort the pregnant women to a hospital for child birth was cited as reason for home birth by 21.5% of the respondents. The road distances were computed using the google map.

Location of hospitals and choice of hospital is depicted in Figure 2.

In order to understand the relationship between distance of hospitals and choice of place of birth, we categorized the distance into near (within 2 km of residence) and far (more than 2 km of residence) as shown in Table 3. In case of those respondents who lived near hospital, 64% chose to deliver in hospital and 61.9% of the pregnant intended to do so, while overall 58% of those who lived away from hospital also chose/intended to give birth in hospital resulting in a difference that was not statistically significant.

We also enquired about the mode of transport used for taking pregnant women to hospital for delivery. A tri-cycle rickshaw was the commonest mode (53%) for those who had already delivered and as well as those who intended to deliver in hospital (58%).

The study also intended to explore the factors prevalent among the pregnant women and their families that determined selection of place of birth. On being asked that what facilities would make them go to a hospital for delivery, the most cited were free services at the hospital, delivery by a doctor and free transport. The same questions were put to all 200 respondents. Of these, 40% had delivered at home. In this bivariate analysis, those who delivered at home or intended to deliver at home were more likely to deliver at hospital if the services were free, distance was approachable and free accommodation provided for accompanying person.

The most common explanations given for home delivery were that there was no time to reach hospital (33.2%), no complications that required going to hospital (20%) and family members not available to accompany them to the hospital (20%).

Logistic regression analysis was performed to determine the contribution of demand side factors in selection of place of delivery. The outcome variable was place of delivery (home versus hospital) and predictor variables were free services at the hospital, free transport to hospital, distance to hospital, delivery by a doctor, cash incentive for delivering at hospital, free food and free accommodation for accompanying person (Table 4).

#### Spatial analysis

In order to detect clustering of cases, if any, cluster and outlier analysis was carried out using Anselin Local Moran's I (ArcGIS 10.3). It showed high clustering in Rajiv Nagar and Kachchi Khajuri areas (Fig.3 ). To further explore this, relative risk of home delivery was calculated using SatScan V9.2 for these areas only and compared with the nearest neighborhood that is Sonia Vihar..

The analysis results are given in Table 5 and visually depicted in Fig 5.

The analysis detected one cluster, namely Rajeev Nagar , where significantly larger clustering of home delivery happened and the relative risk of home delivery was 2.63 ( $p < 0.000012$ )

Nearest Neighbor Analysis (Clarks & Evans Method) <sup>22</sup> : This analysis determines whether features, or the values associated with features, exhibit statistically significant clustering or dispersion over a range of distance and it is measured by Ripley's K function. <sup>23</sup>

Expected nearest neighbor distance (R coefficient: Nearest neighbor Index): The average distance between home delivery cases was 0.0005497 km, hospital delivery was 0.0002671 km, overall 0.0002303 km, suggesting that home delivery cases were more apart from each other, thus unlikely to be influenced by neighborhood effect. There is a significant clustering of home delivery cases as is evident from the graph between 1.6 km and 2.00 km. We otherwise also saw that there is clustering of cases in Rajiv Nagar area.

## Discussion

It has been established through research in various places in India that socio demographic factors like education, income, culture, religious practices and several other factors act as determinants for choice of place of child birth. Studies conducted in slums of Mumbai identified role of illiteracy, poverty as determinants of home delivery<sup>19</sup>. But in a socio-economically homogenous population with similar education levels, income and cultural back ground, what determines place of delivery remained an important unanswered question, therefore in our study, we also included hitherto unaccounted for factors and tried to analyze their impact on choice of place of delivery. In this study, the selection of residential colonies was based on prior knowledge that all chosen colonies were inhabited by low socio-economic status families and their education and income levels were homogeneous. In order to cover geographically spaced out areas within a district, the ten colonies were selected covering almost all clusters of low-socio economic colonies. The overall proportion of home delivery or intended homebirths was 40%, which is higher than the reported rate of homebirths of 20% and 30% in previous studies<sup>20-21</sup>. This is because in our study we have deliberately chosen only low socio-economic population groups, where due to poverty and illiteracy, the prevalence of home delivery was expected to be higher. The validity of the sample is established by the fact that the rate of home delivery (40.6%) and intended home delivery (36.5%) was similar.

Bivariate analysis using 2 km as cut off showed that distance from place of delivery was not an important determinant of home delivery. However, the respondents were also asked to comment about the role of distance in selecting place of delivery. To which responses were mixed. Some respondents said that an acquaintance working in a hospital would make them



prefer that hospital over others irrespective of distance. Similarly, some opined that they would choose a hospital over others if the hospital provided a free ambulance facility, which in fact was being done by one hospital. Only one third of those who delivered at home said that home was selected on account of health facility being far away in terms of physical distance or time available to reach hospital after onset of labor was too short. When asked how far they were willing to travel for delivery, 30 women responded but more than half of them (16) wanted the facility to be within 3 kms, and in fact most, 13 out of these 16, lived more than 3 km away from the place of delivery. Besides distance, there were other practical considerations in choosing place of delivery. Most common being, no one to accompany them to hospital for delivery, as told by 21.5% of the respondents. Perceptions and beliefs also played an important role. As 17% women who chose homebirth believed that since there was no complication during pregnancy, there was no need to go to hospital. It is important to note that fear of stitches, fear of abusive behavior of staff in the hospital, safety concern during stay at hospital and work pressure at home were other reasons cited by these women. The women were also asked to list the facilities which they thought were important in selection of place of delivery. A logistic regression analysis showed that distance was a significant predictor of hospital delivery (Odds Ratio 2.67) along with free services, free transport and free accommodation. Delivery by a doctor was another significant predictor. Though cash incentives and free food were not found to be significant predictors; it could be due to a social desirability bias; respondents not willing to admit that food and cash were important criteria.

Among those who chose to deliver at hospital, the commonest mode of transport was the auto rickshaw (54%) followed by cycle rickshaw (16%). Ambulance provided by the hospital could be used by 9% of those who delivered but 19% of the currently pregnant women hoped to use the ambulance. But in case of rapid progress of labor, particularly in the multi para women, the time available to reach hospital does not permit a long wait for the ambulance. Interestingly, 9 women ‘walked’ to the hospital for delivery and all of them lived within 2 km of the place of delivery. We observed that in some colonies the lanes were so narrow that an ambulance or a car cannot reach the doorstep of the house.

Given that the known sociodemographic determinants of home delivery were homogeneously distributed among the respondents, we thought it pertinent to examine if spatial clustering could explain the high rates of home delivery. Cluster and outlier analysis using Anselin local Morans I showed there was clustering of home deliveries in two neighborhoods. These two



neighborhoods had recent migrants who came from the same part of the country and were poorer than others.

Being relatively new to the city, poverty and peer influence could have contributed to more home deliveries in these areas however this was not explored in depth in our study.

The nearest neighbor analysis was performed to see whether there is any clustering of home deliveries. From the map (Fig 4), we can see that there is clustering of home deliveries in Rajiv Nagar area. Pictorially, the comparison of clustering between Rajiv Nagar and Sonia Vihar is shown in Fig. 8. The clustering was shown in two areas only because the very basis of sampling in this study was clusters and different clusters had different social dynamics in terms of selection of place of delivery.

### **Limitations**

The study is based on a convenience sample, hence it may not be representative of the target population. Geospatial analysis fell short of the expectations because of the small sample size and relatively small geographical area covered in the study.

### **Conclusion**

We tried to understand the decision making for homebirths by women in low socio-economic neighborhoods of metropolitan city. It can certainly be said that we need to take into consideration perceptions of families and their beliefs in order to convince them to go for institutional births. The second important observation is that the decision of homebirth is influenced by availability of transport, short distance to travel and access to no-cost treatment facilities.

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**Table I. Residential colonies from where respondents were interviewed**

Sl. No	Name of colony	Pregnant respondents (n=41)	Delivered respondents (n=164)	Total (n=200)*
1.	Dilshad Colony	7 (17.1)	18 (11.0)	24 (12.0)
2.	Jhilmil Colony	4 (9.8)	11 (6.7)	14 (7.0)
3.	JJ Colony	1 (2.4)	13 (7.9)	14 (7.0)
4.	Kachchi Khajuri	4 (9.8)	12 (7.3)	15 (7.5)
5.	Mansarovar Park	2 (4.9)	14 (8.5)	16 (8.0)
6.	Rajiv Nagar	4 (9.8)	25 (15.2)	28 (14.0)
7.	Seemapuri	3 (7.3)	10 (6.1)	13 (6.5)
8.	Sonia Vihar	2 (4.9)	13 (7.9)	15 (7.5)
9.	Sunder Nagari	5 (12.2)	9 (5.5)	14 (7.0)
10.	Welcome Colony	9 (22.0)	39 (23.8)	47 (23.5)

**Table II. Reasons for selecting home as place for giving birth**

	Pregnant (n=15)	Home Delivered (n=65) <sup>a</sup>	Total (n=79)
No Complications	0 (0.0)	13 (20.0)	14 (17.7)
Prohibitive distance/time	4 (26.6)	24 (33.9)	28 (35.4)
Transport not available	0 (0.0)	1 (1.5)	1 (1.3)
Work pressure at home	3 (20.0)	3 (4.6)	6 (7.6)
No one to accompany	4 (26.6)	13 (20.0)	17 (21.5)
Delivery by male doctor	2 (13.3)	0 (0.0)	2 (2.6)
Abusive behaviour at hospital	4 (26.6)	0 (0.0)	4 (5.2)
No money for hospital	0 (0.0)	3 (4.6)	3 (3.8)
Poor quality of service at hospital	0 (0.0)	2 (3.1)	2 (2.6)
Sent back by hospital	0 (0.0)	3 (4.6)	3 (3.8)
Fear of hospital	2 (13.3)	5 (7.7)	7 (8.9)
Lack of safety	3 (20.0)	0 (0.0)	3 (3.8)

\* One woman did not give any reason, \*\* Multiple responses were given

**Table III: Role of distance to hospital in selection of place of delivery**

Location	Hospital Deliveries	Home deliveries	Total	P
<u>Delivered</u>				
Near hospital	40 (64.5)	22 (35.5)	62 (37.8)	0.259
Away from hospital	58 (56.9)	44 (43.1)	102 (62.2)	
<u>Pregnant</u>				
Near hospital	13 (61.9)	8 (38.1)	21 (51.2)	0.906
Away from hospital	13 (65.0)	7 (35.0)	20 (48.8)	
<u>All considered together</u>				
Near Hospital	51 (63.0)	30 (37.0)	81 (40.5)	0.395
Away from hospital	69 (58.0)	50 (42.0)	119 (59.5)	

**Table IV: Logistic regression analysis showing predictors of institutional delivery**

Predictors	Odds Ratio	z	P	95% Confidence interval	
Free services at hospital	2.55	2.69	0.007	1.29	5.03
Free transport to hospital	2.04	1.66	0.097	0.88	4.77
Distance to hospital	2.67	2.73	0.006	1.32	5.41
Delivery by doctor	2.57	2.30	0.021	1.15	5.76
Cash incentive	0.50	-1.24	0.213	0.18	1.47
Free food	0.92	-0.18	0.856	0.39	2.20
Free accommodation	2.20	1.95	0.052	0.99	4.9

**Table V. Cluster detection analysis to determine clustering of home delivery**

Location IDs included.: 12, 135, 132, 9, 6, 133, 7, 174, 11, 10, 134, 8, 95, 97, 93, 91, 92, 94, 188, 98, 96, 141, 187, 140, 139, 142, 143, 78, 13, 136, 144, 137, 14, 138

Overlap with clusters.: No Overlap

Coordinates / radius.: (28.712080 N, 77.251377 E) / 0.42 km

Gini Cluster.....: Yes

Population.....: 34

Number of cases.....: 28

Expected cases.....: 13.60

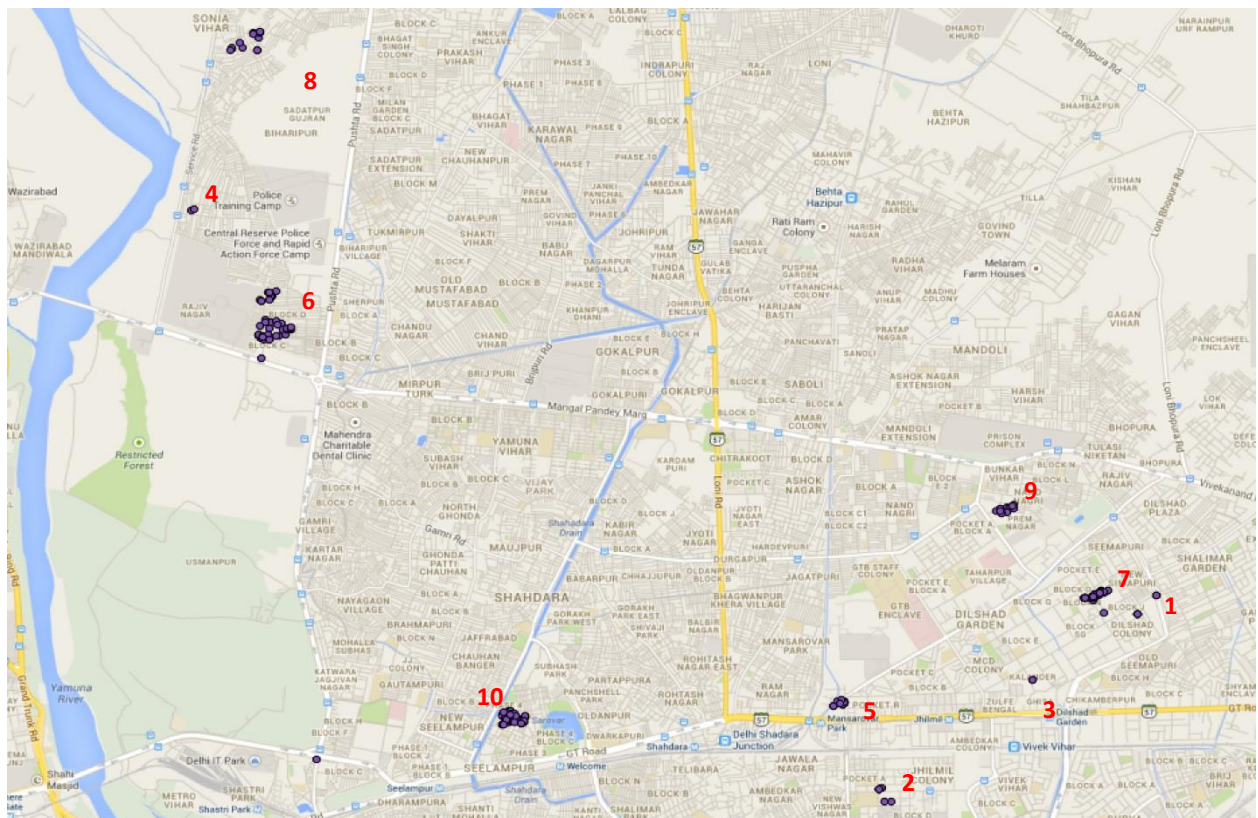
Observed / expected...: 2.06

Relative risk.....: 2.63

Percent cases in area.: 82.4

Log likelihood ratio..: 15.559682

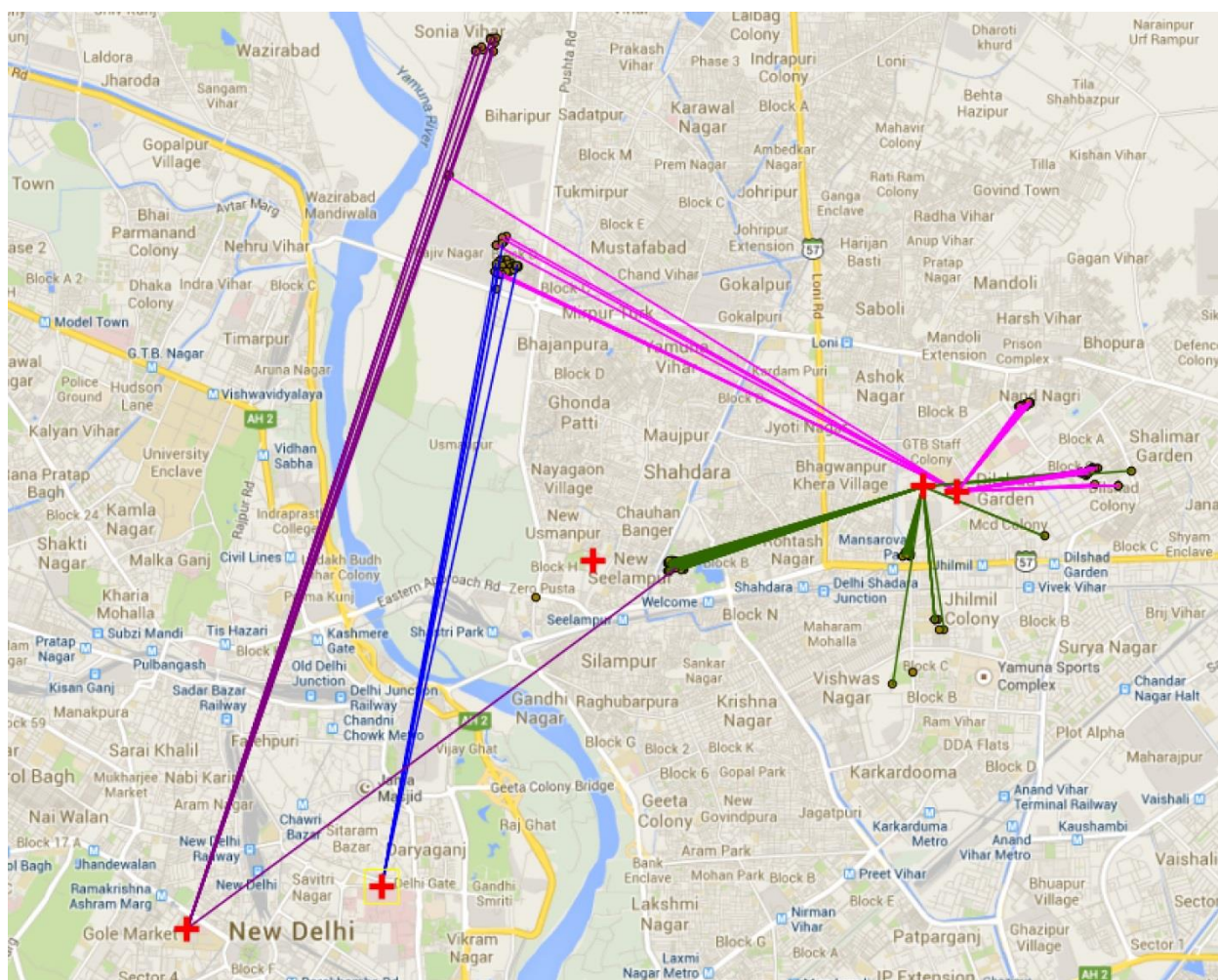
P-value.....: 0.000012

**Fig 1. Geographical location of the surveyed colonies**


1. Dilshad Colony, 2. Jhilmil Colony, 3. JJ Colony, 4. Kachchi Khajuri, 5. Mansarovar Park, 6. Rajiv Nagar, 7. Seemapuri, 8. Sonia Vihar, 9. Sunder Nagari, 10. Welcome Colony



**Fig. 2. Choice of Hospitals for deliveries**



- + location of hospital

Fig 3. Map showing Anselin Morans I

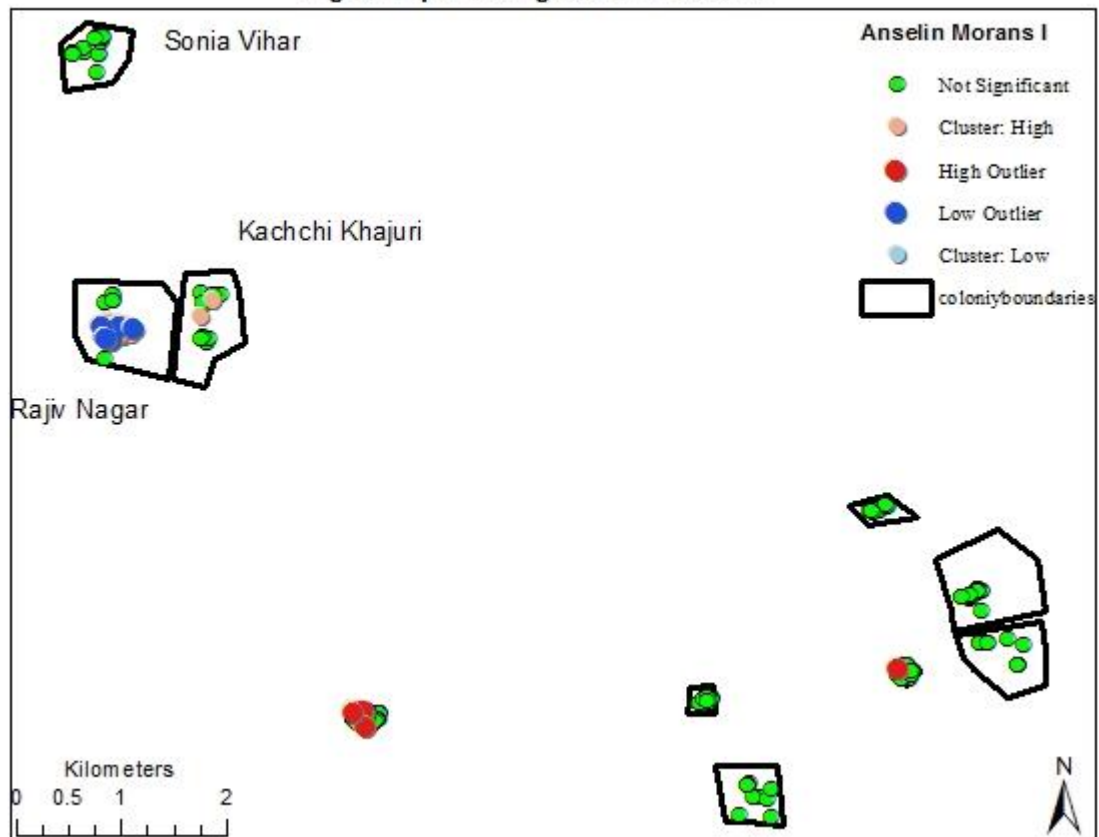


Fig 4 Map showing clustering\* of home delivery

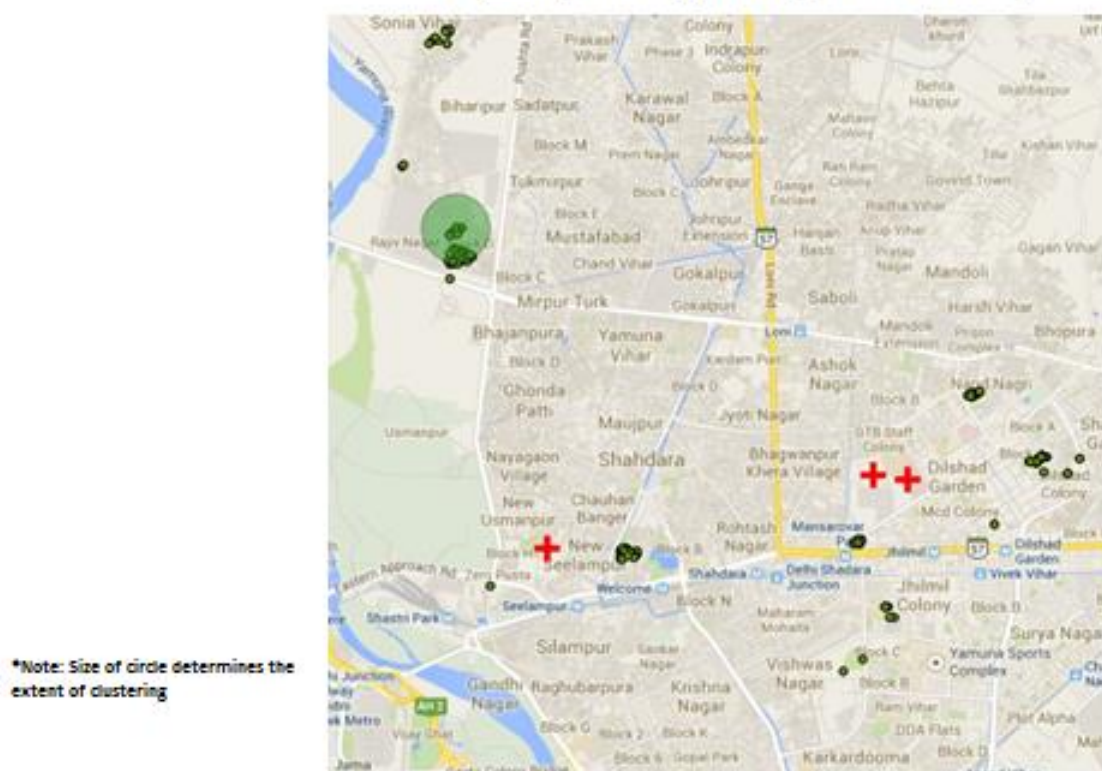


Fig 5 Comparison of clustering of home delivery in Sonia Vihar and Rajiv Nagar

